Sandia National Laboratories

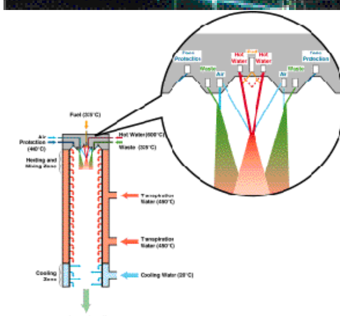
Fact Sheet

Supercritical Water Oxidation
Basic Research and Technology Development

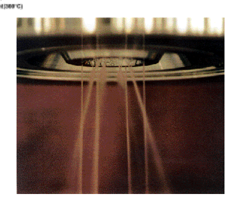
Basic kinetics research and reactor conceptual design

The development of reliable kinetic models for oxidizing complicated feeds in supercritical water has underpinned Sandia's technology development role in supercritical water oxidation (SCWO). SERDP project "Kinetics of Supercritical Water Oxidation" was a multiyear effort directed at quantifying the reaction kinetics of waste feed materials typically found at DoD and DOE facilities. Recently completed work concluded that combustion-based models are appropriate for supercritical water conditions and that quantitative detailed kinetics based on elementary reactions can be used to predict the conversion rates and other important SCWO system parameters.

Sandia helped implement GenCorp Aerojet's platelet technology for mitigating corrosion and scaling in SCWO systems. Sandia's bench-scale testing, supported by DOE and DoD, provided proof of concept for the transpiring wall reactor (TWR). The TWR preserves a boundary layer of clean supercritical water on the reactor's inner wall, protecting it from corrosive gases produced by waste oxidation. This boundary layer also prevents build-up of inorganic salts. The TWR eliminates concerns about pressure vessel susceptibility to stress corrosion cracking, since it is never directly exposed to the reacting materials. The TWR is designed to operate at higher internal temperatures than is possible in a single-walled vessel, due to the platelet's thermal management capabilities.



TWR systems utilize minimal feed preheating prior to entering the reactor. In this operating mode, most of the heat necessary for the required reaction temperature comes from the oxidation of the feed itself. Sandia's kinetic models, developed under the SERDP program, have provided critical technical data for development of Aerojet's unique injector design. Oxidation reactions are initiated at the reactor inlet. Sandia is also developing computational tools that accommodate the high density, buoyant flow in these reactor designs. This enables better prediction of the overall system behavior and optimization of operating conditions.



For more information contact:
Sandia National Laboratories
Mary Clare Stoddard *at (925) 294-2056*
mcstodd@sandia.gov
Steven F. Rice *at (925) 294-1353* *sfrice@sandia.gov*

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.
SAND2001-8327P